[EE] Evening Poster | A (Atmospheric and Hydrospheric Sciences) | A-HW Hydrology & Water Environment

[A-HW20]Materials transport and nutrient cycles in watersheds; Human and climate impacts

convener:Mitsuyo Saito(Graduate School of Environmental and Life Science, Okayama University), Shin-ichi Onodera(Graduate School of Integrated and Arts Sciences, Hiroshima University), Takahiro Hosono(熊本大学大学院先導機構, 共同), Adina Paytan(University of California Santa Cruz)

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This session aims to synthetize watershed sciences in order to understand dynamical processes of materials transport and nutrient cycles in watersheds from headwaters to coastal seas focusing on human and climate impacts. The session will be integrating a variety of research disciplines including limnology, ground water hydrology, coastal oceanography, meteorology, pedology, sedimentology, forestry, agriculture, fishery, social science and more. The watershed sciences also challenge us to solve environmental issues emerged in the watersheds through our profound understanding of relations between humanity and nature. For instance, on one hand, human land uses alter water resources, dynamics of sediments, nutrients and pollutants in waters and soils on watershed scales, while changing climates may alter water cycle, the frequency and intensity of materials transport and natural disaster, sometimes having catastrophic effects on the watershed systems. This session also calls for ideas on new methods for the watershed sciences, such as tracer and molecular technique, hydrological modeling, paleontological approaches, laboratory and field experiments, social-scientific evaluation of ecosystem services and social-ecological systems, and so on, in order to elucidate physical, chemical and biological mechanisms for shedding light on natural phenomena and their changes over time in complex and dynamic watershed systems. Through this session, we would like to facilitate interdisciplinary collaboration among participants to create new knowledge on watershed sciences.

[AHW20-P12]Spatial variations of stable isotopic and biogeochemical properties at headwater catchments

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1. Introduction

It is well known that there is an altitude effect on hydrogen and oxygen isotopic ratios in high mountain areas. Because this feature can be a useful trail of shallow ground water discharge which is originated from rainfall, a lot of researches have been carried out. However, research in the high mountain basin is difficult for many reasons, so there are not many examples in the past. The aim of our research is to confirm stable isotopic and biogeochemical properties in high mountain area. Therefore, we report on the results of the research targeting Ishizuchi Mountains, the highest mountain in western Japan.

2. Study area and methodology

The study is held in Ishizuchi Mountains located in Ehime prefecture, western Japan. Mt. Ishizuchi (1,982m) is the highest mountain in western Japan and ranges only 18km to the top from river mouth. The main river named Kamo River has 191.8 km^2 of basin and flows into Seto Inland Sea. Yearly precipitation in mountain

area is about 2,800mm, while it is about 1,600mm in downstream area. We conducted a field research in May and December in 2017 to collect 47 water samples including spring water, stream water and snow. To know the property, we analyzed in hydrogen and oxygen isotopic ratios, nutrients and other cations/anions.

3. Result and discussion

Regarding the spatial distribution of hydrological characteristics in the Ishizuchi Mountains, the following characteristics can be confirmed in the biogeochemical processes due to differences in air temperature, soil moisture conditions, groundwater cycle time in the upstream, middle and downstream areas.

1) The altitude effect of isotopic ratios in Ishizuchi Mountains was -0.12˜-0.11‰/100m. With this effect, the recharging altitude of spring water for domestic use of local people was estimated 800˜1,200m. The isotopic rations at higher altitude in December was smaller than that in May. This is because heavy rain in high altitude during rainy and typhoon season brought lighter raindrop (amount effect). “d-excess”, an indicator of evaporating environment of sea water, showed a seasonal change. It means that ground water discharge cycle was within a year. d-excess also showed an altitude effect. It was bigger at higher altitude only over 1,200m. From this data, the ground water could cycle in a relatively shorter time at a higher altitude.

2) Carbon dioxide partial pressure (pCO_2), indicating the degree of biological activity, increased in the upstream. It is suggested that the bioactivity depends on soil moisture condition, not on water temperature in Ishizuchi Mountains, because the difference in precipitation and evapotranspiration between the upper and lower part of basin is largely different. This can be said to be due to the characteristics of the Seto-uchi climate, where the rainfall in the mountains and the coastal area are quite different.

3) It was suggested that rock weathering in the upper part was suppressed by the low water temperature in the Ishizuchi Mountains. Generally, when carbon dioxide is generated by biological activity, rock weathering is also promoted, but it seems that elution did not progress in the upstream part of basin due to the short groundwater cycle. In a point of total amount, upstream area supplies more nutrients than anywhere else. This is because heavy precipitation and less evapotranspiration at upstream area.